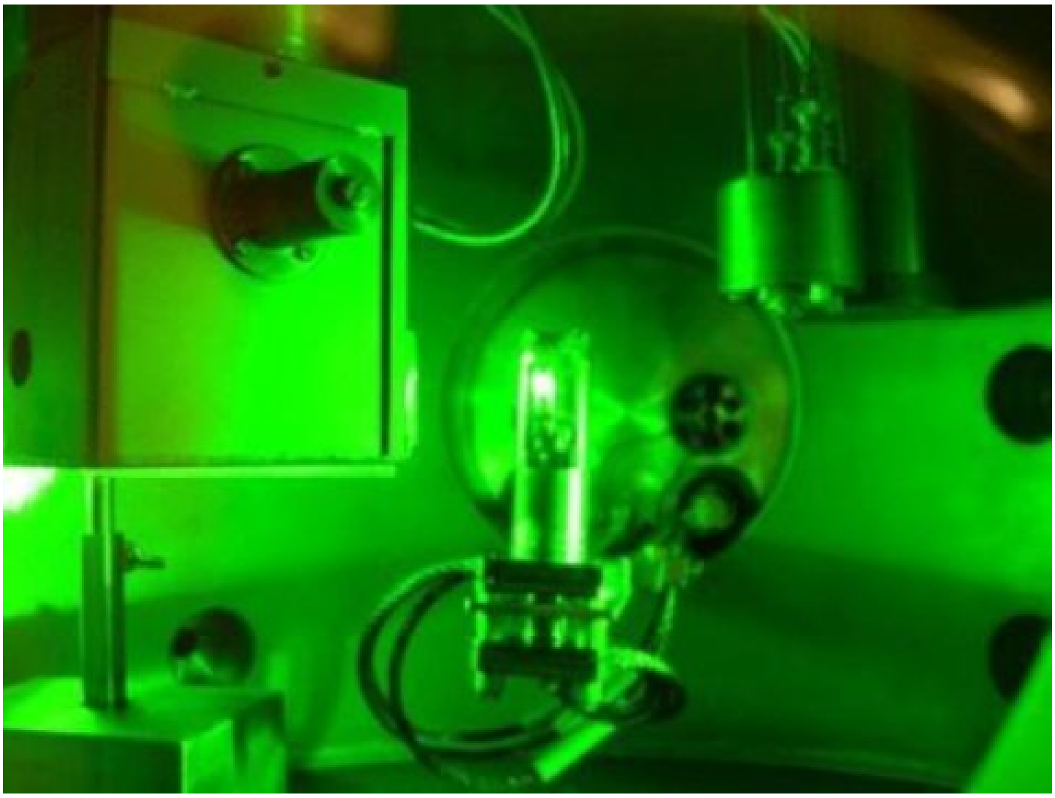
The Role of Lithium in LENR - *Part two*

The synergy Lithium – Iron

Recently, Dr. Francesco Celani brought to the attention of researchers involved in LENR , a patent of *L. Holmlid , EP2680271, "Method and apparatus for generating energy through inertial confinement fusion"* , https://data.epo.org/publication-server/rest/v1.0/publication-dates/20140101/patents/EP2680271NWA1/document.pdf
which it is a major synthesis of trials conducted by the author in conjunction with other important researchers including G. Miley.



Holmlid experiments : laser on ultra-dense deuterium

In this work the emphasis is put on methods to compress the hydrogen (or its isotopes) at the level of extremely high density, of the order of 50 Kg / cm^3, in the surface regions of a solid matrix by the special hydrogen absorption capacity of , bringing the nuclei at distances very narrow of the order of a few picometres (10^{-12} m). The subsequent use of stimulation (the developer applies a laser capable of generating pulses of a duration of tens of nanoseconds, and by 6 J / pulse provides an

instantaneous power of 600 MW) is sufficient to turn on the fusion, according to the Lawson criterion that binds the power required for ignition and the density of solicited hydrogen nuclei.
The hydrogen flows through the pores of the matrix (of the order of 100 nm) and, owing to the catalytic activity of this, is first brought from the molecular to atomic state, and subsequently, on the surface of the catalyst, to the "ultra-dense" state.
Holmlid employs a commercial catalyst used for the production of styrene by dehydrogenation of ethylbenzene.
This catalyst exploits the ability of the iron oxide to break the H_2 molecule that is absorbed, under pressure, by the porous surface and accumulates in **ultra-dense** phase clustered in the defects of the lattice solid caused by the addition of an alkaline element (Li, K, Na) due to the strong difference between atomic dimensions. (The commercial catalyst chosen contains Fe_2O_3 and approximately 10% K_2O).
The ultra-dense phase proved to be very stable in time.

At this point there is a clear independent confirmation of how recently shown experimentally by F. Celani, and reported at the **ICCF19** of Padua, (*F.Celani, "Observation of macroscopic current and thermal anomalies, at HT, by hetero-structures on thin and long Constantan wires under H_2 gas":*

http://www.francescocelanienergy.org/files/Celani_ICCF19_abstract.pdf

about the improvement of performance of the "Celani wire" by the addition of layers of nanostructured Fe. We assume that they could have raised the presence of **stable** clusters of dissociated hydrogen at high density, favorable to the occurrence of abnormal heat generation. The same clusters, with non-homogeneous distribution in the sense (as well as radial) of the longitudinal wire (because of the asymmetry of the electrical stress) are probably responsible for the observed new effect about the production of a macroscopic and stable ΔV at the ends of the only-constantan nanostructured wire.

In the same direction are the results of our tests on mixtures of micro powders Ni-Fe in a hydrogen atmosphere and under electrical impulsive solicitation, showing significant differences in the thermal behavior compared to reference tests with Ni alone.

So as we think interesting to propose the addition of alkaline elements (or Ca) in the “Celani wire” to increase the lattice defects, and consequently the trapped superdense phase of hydrogen, in the same way in our experimentation we plan the addition of Li with dual purpose:

- creating structural defects in iron, to accommodate the ultra-dense clusters of hydrogen

- providing an alternative nuclear fuel to the scheme Deuterium-Tritium (radioactive) or Deuterium-Deuterium (high activation energy).

During the **ICCF19**, U. Mastromatteo (*U. Mastromatteo, "LENR anomalies in Pd-H*$_2$ *systems submitted to laser stimulation*":

http://www.claudiopace.it/iccf19-ubaldo-mastromatteos-conference-at-iccf19/

presented the results of stimulation by low power laser on thin films of palladium in which **dense** deuterium is trapped, noting local outbreaks attributable to nuclear fuel, in perfect keeping with the above, probably furtherly increasable (we assume) adopting a doping metal alkali that increases the density of the deuterium in the lattice defects.

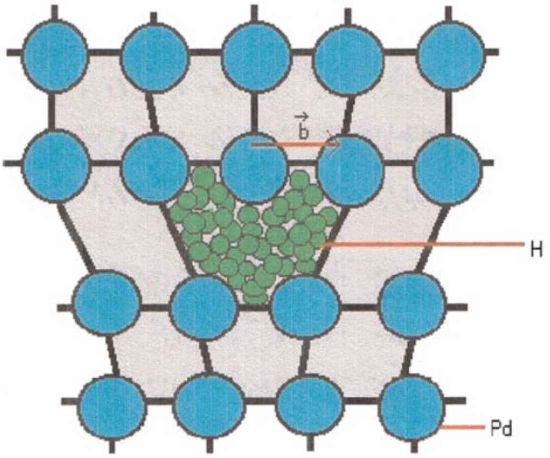
Even in an area seemingly separate from the energy production by LENR, namely in the field of stabilization of radioactive elements in the wastes from nuclear plants, Y. Iwamura has long worked with mechanisms based on permeation of hydrogen isotopes through electrolytic deposits (dynamic) of cations of radioactive elements on composite cathodes containing nano-structured interfaces between multiple layers of metal oxides in which structural defects we assume the formation of ultra-dense clusters of matter that facilitate the intimate contact necessary for the transmutations in view of abatement of radioactivity.

Neither the reactor E-cat of A. Rossi escapes hypothesis of applicability of the model outlined. According to what is apparent from relative reports, the release at high temperature (and hence pressure) of hydrogen from lithium aluminum hydride mixed with the powder of Nickel, can form clusters of hydrogen ultra-dense both in the Li that at the interface with the grains of Ni, making it more likely, with the proximity between the nuclei, the *tunnel* effect to overcome the Coulomb repulsion both with the help of the temperature and of the thermoelectric local effects between Li and Ni (localization of energy of B.Ahern).

Now, this brief discussion can take advantage of the results presented by G. Miley and L. Holmlid in a joint communication on *Laser and Particle beams, 2009 - Cambridge University Press*, entitled "*Ultrahigh-density deuterium of Rydberg matter clusters for inertial confinement fusion targets*

https://newt.phys.unsw.edu.au/STAFF/VISITING_FELLOWS%26PROFESSORS/pdf/MileyClustLPB.pdf

There are shown the experimental results **demonstrating** the crystals of the alkali metals (particularly lithium) are able to form stable clusters of "Rydberg matter", i.e. sets of atoms in which the orbits of the hydrogen peripheral electrons are close to the level of ionization and give the atom a polar character, responsible for a strong aggregation in **ultra-dense** phase.



Rydberg Matter in lattice defects (G. Miley)

Such clusters may be formed, as a rule, at the metal-oxide **interfaces** (as shown by Miley in the Fe_2O_3 doped with K): in crystalline defects he detected ultra-dense hydrogen with a density of 10^{+29} ions / cm^3, at distances between the nuclei of the order of picometre, measuring 10^{+10} defects /cm^2 of film.

The lattice would not bear the stres induced by more than one defect per 10 atoms, but if the voids are filled with the ultra-dense material, stress is reduced and maintains the crystal intact.

Moreover, the most interesting fact is that the clusters of ultra-dense hydrogen can be formed **in the entire volume of the lithium** with crystal defects.

Miley calculates that the particular distribution of clusters of ultra-dense hydrogen in crystals of Li can lead, with laser solicitations of modest power, to **COP** order of at least **200** (lower limit !).

The laser solicitation is obviously **not the only one possible**. P. Soininen, in patentWO2013076378A2 entitled *"Thermal energy-producing system and method":*

http://www.google.com/patents/WO2013076378A2?cl=en

binds the many aspects sketched above, referring to the same works shown here, proposing a general framework involving:

- a metal matrix capable of absorbing hydrogen at levels of ultra-dense Rydberg matter (actually it was observed in Li, K, Na, Ni, Pd)
- an alkaline doping introducing lattice defects

- a dielectric capable of stabilizing the lattice, avoiding the elimination of the defects by rearrangements of the structure, and characterized by the capability of promoting the formation of high electric fields
- nanometric grain of the components, in order for the creation of very high electric fields at the interfaces, caused by the addition of pyroelectric, piezoelectric or magnetoelectric materials subjected respectively to thermal, magnetic or sonic stresses.
- the mechanism expects the hydrogen, in the form of Rydberg matter, in ultra-dense state, in clusters accommodated in the lattice defects, is **hypersolicited** by induced electric fields, until fusion occurs.

The framework of Soininen can be finally taken as a track to explain **our experimental line** (filed for **patent application** on March 9, 2015) that includes the basics but introduces, in natural continuation, the **highly impulsive electrical stress** and **the mixture (at the cathode) of nanopowders of various metals**, including lithium in quantities not restricted to just the doping, iron, and boron-based dielectric.

The following new effects are thus expected:

- ionized hydrogen compression, to permeate the matrix
- energy localization at the grain interfaces, to overcome the critical threshold of ignition
- availability of lithium as nuclear fuel (Li-proton, alternative to D-D and D-T)
- participation of the boron to neutron-proton dynamics
- thermoelectric effects between Li-Ni and Ni-Fe
- driven migration of ionized hydrogen by the directed electric field towards the **dense accumulation** in the cathodic region
- promotion of magnetic effects related to the electric field pulse,
-

with the dual objective both in **energy production** and **stabilization of radioactive materials.**

Ugo Abundo – Open Power Association